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MAGNETIC APPLICATOR FOR DEPOSITING POLYMER COATINGS ON QUARTZ LIGHT GUIDES

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The operating principle and characteristics of applicators based on disperse magnetic systems intended for deposition of protective polymer coatings on quartz light guides are described. The possibility of controlling the parameters of coatings in drawing light guides is demonstrated.

Application of protective coatings onto fibrous light guides is part of their manufacturing process. The mechanical and geometrical parameters of the coating deposited have a significant effect on the quality of light guides.

The geometrical parameters (concentricity and thickness) to a large extent depend on the method of applying coatings and on the particular device for its deposition. Applicators are widely used for this purpose [1 – 3].

Among a variety of applicators used for the deposition of protective coating on light guides, two types can be isolated: glass applicators and applicators of complex configurations operating under increased pressure of polymer. Glass applicators are simple to make. Furthermore, they make it possible to monitor the behavior of the polymer (or lacquer) when deposited on a light guide. The transparency of such applicator facilitates the alignment of the light guide with respect to the applicator opening, which facilitates obtaining a concentric coating. The second type of applicator makes it possible to control the thickness of the coating applied by varying the polymer pressure.

We propose a new type of applicator based on the principle of disperse magnetic systems (i.e., magnetic fluids) and making it possible to control the thickness of coatings by varying the strength of current in an electromagnet induction coil. These are the results of upgrading devices developed at the Ivanovo Power Institute.

The principle of the effect of these applicators is based on interaction of three media: a magnetic fluid, a polymer (or lacquer), and a moving light guide [4]. As a consequence of interaction between these media, a funnel is formed in the magnetic fluid body, which represents an applicator enabling one to coat the light guide with a polymer (Fig. 1*a*). In spite of laterals shifts of the light guide in the magnetic fluid, the funnel remains symmetric with regard to the light guide.

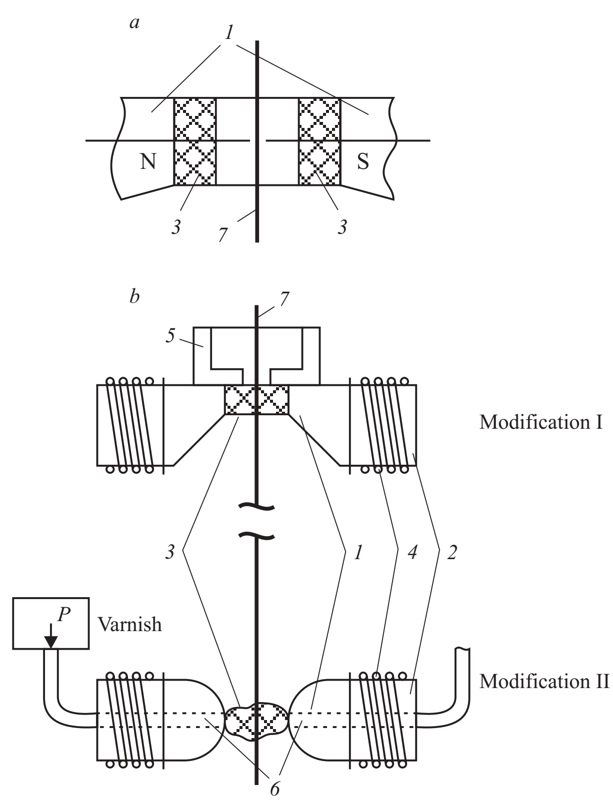

Fig. 1. Scheme of magnetic applicators.

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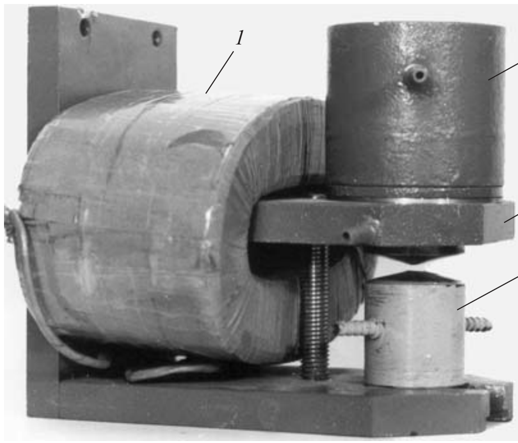

Fig. 2. Experimental electromagnetic applicators: *1*) induction coil; *2*) electromagnet poles; *3* and *4*) magnetic applicators for depositing polymer and lacquer, respectively.

The magnetic fluid used was the organosilicon polymer SIEL with ferromagnetic inclusions in the form of powder with spherical particles around 40 μm in diameter. A sponge is developed in the pole pieces consisting of ferromagnetic spherical particles below 1 μm in diameter and is used for lacquer deposition.

The design of the magnetic applicator is demonstrated in Fig. 1*b*. It has two modifications: I) for organosilicon SIEL (coating thickness 30 – 60 μm); II) for secondary lacquer coating (thickness 4 – 12 μm).

Each modification consists of two pole pieces *1* and electromagnet *2*. Magnetic fluid *3* was placed in the center between the pole pieces. The magnetic field of electromagnets was regulated by varying the strength of the current in the coil *4*. A polymer (modification I) was fed into a glass vessel *5* with an opening for the magnetic fluid. Lacquer for the secondary coating arrived under a pressure *P* via opening *6* in the electromagnet pole pieces into a magnetic fluid sponge.

A funnel is formed in the applicator in passing the technological segments of the light guide *7* (the strength of the current supplied to the electromagnet coil being constant). As the funnel is filled with the polymer (lacquer), its sizes stabilize.

The external appearance of the magnetic applicators is shown in Fig. 2.

By varying the strength of current *I* in the electromagnet coil, it is possible to vary the thickness *d* of the organosilicon coating on the light guide by up to about 50% (Fig. 3, curve *1*). The thickness of the lacquer coating can be modified in the applicator II by varying the pressure of the lacquer together with varying the strength of the current (Fig. 3, curves *2* and *3*).

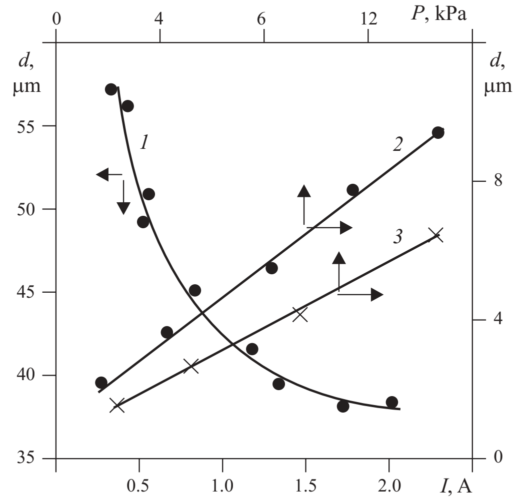

Fig. 3. Variation of thickness of light-guide coating versus the variation of strength of current (*1*) and pressure of lacquer for strength of current I_1 (*2*) and I_2 (*3*).

An important advantage of these applicators is that they need not be aligned very precisely. The light guide itself by being deflected in the working body (magnetic fluid) within the limits of ± 2 mm from the axis ensures the coaxial position of coating. This property of the applicator can be used for depositing protective coatings on light guides with any complex profile.

The testing of magnetic applicators performed on several drawing devices demonstrated that the applicators operate successfully: the coaxiality of polymer (lacquer) coatings of the light guides is 5%. The strength of the light guides is at the same level as that of light guides coated using standard applicators [3]. A specific feature in operating magnetic applicators is the necessity of replacing the magnetic fluid before each drawing; however, in contrast to the practice of using mechanical applicators, complicated cleaning and washing procedures are not required.

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